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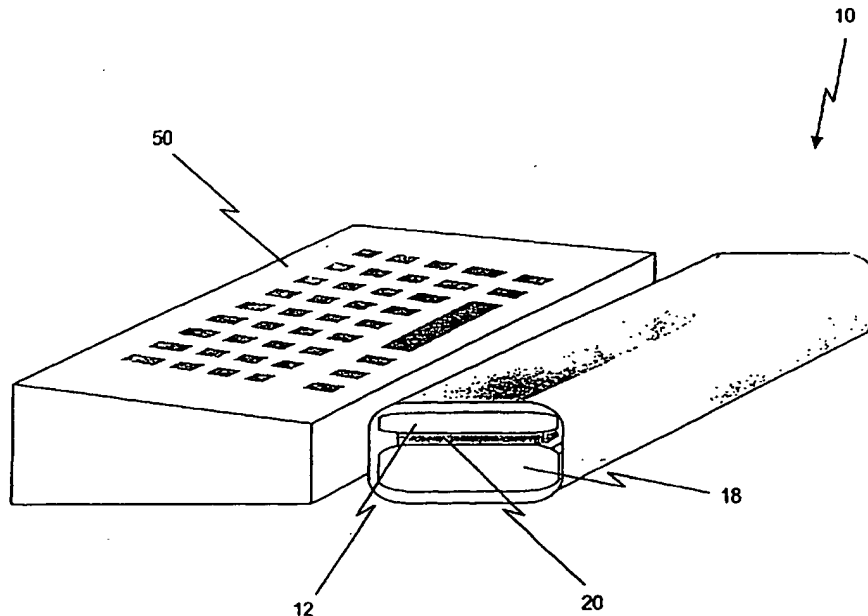
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(54) Title: **DUAL DENSITY HEATED DEFORMABLE SUPPORT**



(57) Abstract: A heated, deformable support for placement adjacent to a computer keyboard or mouse to support the operator's wrist or hand. The support includes flexible upper and lower support layers having a heating mechanism interposed between them. The lower support layer is thermally insulating relative to the upper support layer. Heat from the support is transferred to the operator's wrist or hand, and the support deforms to conform to the wrist or hand, to provide comfort and relieve stress during operation of the keyboard or mouse.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

DUAL DENSITY HEATED DEFORMABLE SUPPORT

Field of the Invention

This invention relates to a dual density, heated, deformable support for a person's wrist or hand. The support may be used in conjunction with a computer keyboard or mouse to increase comfort or relieve stress on the wrist or hand during operation thereof.

Background of the Invention

Continuous operation of a device such as a computer keyboard or mouse may lead to fatigue or discomfort in the region of the operator's hand or wrist. Additionally, continuous operation over a substantial period of time may lead to repetitive motion stress injury, an example of which is carpal tunnel syndrome.

To relieve fatigue and inhibit the onset of repetitive motion stress injury, various supports for the operator's hand or wrist have been proposed. For example, some supports aim to maintain the operator's hand or wrist in a predetermined, ergonomically desirable orientation during operation of a keyboard or mouse. In such supports, the operator's hand or wrist is supported on a rigid surface.

US Patent Nos. 5,674,423 and 5,686,005 disclose a heated pad especially adapted for use in conjunction with a computer keyboard or mouse. The top surface of the pad includes a support surface for a user's wrist, this surface being planar or having a curved depression. An electrical heating unit is embedded in a layer beneath the support surface, such that heat is delivered to the operator's hand and wrist during operation of the keyboard or mouse, and thereby treats stress to the hand and wrist while operating the keyboard or mouse. The support described in these patents supplies heat to the operator's wrist or hand, but the support is rigid. Additionally, assembly or manufacture of such a device is relatively complicated.

Summary of the Invention

This invention provides a heated support device for supporting at least a portion of the wrist or hand. The device is particularly applicable to being placed on a flat surface such as a desktop for use during operation of a computer keyboard, mouse or similar finger-operated device. The device provides heat to a wrist or hand to relieve fatigue or reduce stress induced by repetitive motion. However, the design of the present invention may be used to support other parts of the body; for example, it may be placed on a chair back to support the head or neck.

The device has two layers, including an upper support layer, which has a flexible, deformable body that at least partially conforms to the operator's wrist or

hand when supported thereon, and a base layer of cushioning foam. The combination of layers provides comfort to the operator, while taking advantage of the low cost and high availability of foam. The heated support device is relatively easy and inexpensive to manufacture and assemble.

5 According to embodiments of this invention, the device comprises the upper support layer and the foam layer, as well as a heating mechanism located intermediate the two layers. Heat from the heating mechanism is transferred through the upper support layer to a wrist or hand supported by the upper support layer. Alternatively, a heat conductive plate could separate the two layers and a
10 separate heating mechanism could be thermally coupled to the conductive plate.

 As foam is relatively inexpensive, the dual density heated support device is cheaper and easier to produce than previous supports. It also takes less time and energy for heat to reach a user than a comparably sized prior art support because the heating mechanism is nearer the user. It is either directly beneath or in contact
15 with the upper layer. Because only the upper support layer needs to be heated in the present invention, the foam layer in a preferred embodiment has a low thermal conductivity so that no heat gets conducted away from the user.

 According to other embodiments, two devices are provided, each of the devices comprising an upper support layer, which has a flexible, deformable, heat
20 conductive body member. The body member of the first device has a length sufficient to accommodate placement of two wrists of a person on the upper surface thereof, and the body member of the second device has a length sufficient to accommodate placement of only one wrist of a person on the upper surface thereof. Preferably, the first device is adapted for placement adjacent a computer
25 keyboard, and the second device is adapted for placement adjacent a computer mouse. The heat source of the first device is in electrical connection with a power source, and the heat source of the second device may be connected in series to the power source through the first device.

Brief Description of the Drawings

30 Figure 1 is a perspective view of an embodiment of the present invention alongside a keyboard;

 Figure 2 is a exploded view of elements of the invention;

 Figure 3 is a perspective view of a heating mechanism used in the present invention;

35 Figure 4 is a side view of the invention shown in cross-section;

 Figure 5 is a side view of an embodiment of the invention including a heat-reflective layer;

 Figure 6 is a side view of an embodiment of the invention including a heat distribution plate;

Figure 7 is a perspective view of the heat distribution plate.

Figure 8 is a perspective view of an input device incorporating the deformable heating element.

Figure 9 is a cross sectional view of a gel filled bladder with an embedded heating element.

Figure 10 is a perspective view of a tray for supporting an input device, wherein the tray incorporates a deformable heater.

Detailed Description of the Preferred Embodiment

Referring to the drawings, which are all in schematic form, the present invention is a dual density heated deformable support device 10 for a wrist or hand. Figure 1 shows the support 10 designed for placement on a work surface adjacent a computer keyboard 50, so that at least a portion of a keyboard user's hand or wrist is supported on the support. Generally, the illustrated embodiment will be placed directly against the bottom edge of the keyboard 50, although an individual operator may desire to place the support device a slight distance from this keyboard bottom edge. The device may be referred to herein as a wrist support, but it is understood that, depending on how close the operator chooses to place the support with respect to a keyboard, or how far the operator's hand extends over the keyboard, the device may support a portion of the wrist and/or the hand, or even part of the arm above the wrist area. It should also be understood that the device may be configured to support other parts of a user's anatomy. For example, instead of being placed on a work surface, it could be placed on a chair-back and used to support the head, neck or lumbar region.

The heated support device 10 includes a flexible, deformable upper support member or layer 12. The operator places his or her wrists on the upper support layer when using a data entry device such as a keyboard. By describing the upper support 12 member as flexible, it is meant that the upper support member 12 is non-rigid and pliable. By describing the upper support member 12 as deformable, it is meant that the upper support member 12 deforms under the weight of an operator's wrists placed thereon. Additionally, it is important that upper support member 12 be relatively heat conductive since, as explained in more detail below, heat is transferred through the support member to an operator's wrist placed thereon.

In the illustrated embodiment, upper support member 12 has the form of an elongate, sealed, flexible casing or bladder 14 at least partially filled with a liquid-containing medium 16. The casing 14 may be substantially filled with the liquid medium, that is, filled in a manner that substantially no air or other gases, other than minor amounts of gas dissolved in the liquid medium, are present in the casing interior.

The upper support layer 12 deforms when the operator's wrist is rested thereon, i.e., for the described embodiment, a portion of the fluid in the region contacted by the operator's wrist will be displaced to another region of the casing 14. However, it is preferred that not all fluid in this contacted region be displaced, so that the fluid in the support member provides a conforming, cushioned surface for a wrist placed thereon. For the described embodiment, the deformability of the upper support member 12 will depend on the flexibility of the casing 14, the pressure at which the casing 14 is filled with the liquid 16, and the viscosity of the liquid 16. The casing 14 may be formed of any relatively pliable plastic, such as a pliable polyurethane elastomer. The liquid 16 preferably has a viscosity higher than water, more preferably a viscosity higher than 1 poise at 20° C, and most preferably a viscosity of at least 15 poise at 20° C, but the viscosity should not be high enough to unduly inhibit deformability of the upper support member. For example, liquid-based gels having some flowability at room temperature are representative of liquid-containing media approaching the desired upper range of viscosity. One particular embodiment of a liquid-containing medium is a composition comprising thickened corn syrup and water. The pressure at which the casing 14 is filled may be selected according to the specific liquid composition and casing flexibility.

Below the upper support layer 12 is a lower support layer 18. In a preferred embodiment the lower support layer 18 is composed of a layer of foam material. The lower support layer 18 will generally be flexible and deformable, though it may be so to a greater or lesser degree than upper support layer 12. The big advantage to using foam is that it is much cheaper than using a larger gel-filled layer. The lower support layer 18 is preferably thermally insulating relative to the upper support layer 12. Otherwise it will conduct heat away from or out of the upper support layer 12. The relative thickness of the two layers may be varied. In a preferred embodiment for a wrist support, the wrist support is approximately 1 inch (25 mm) thick. The upper support member preferably has a thickness of between 0.1 and 0.5 inches (2.5 and 13 mm), and more preferably has a thickness less than or equal to 0.375 inches (10 mm). The lower support layer 18 has a thickness such that when it is placed under the upper support layer 12, the total thickness of the support is 1 inch (25 mm). This thickness is preferred for the wrist support. However, if the device were being used for different purposes the thickness could be varied. If it were used as a head support, for example, it would preferably be thicker. However, the upper and lower layers would still be present in roughly the same ratios, i.e., between 1:9 and 1:1 respectively, preferably 3:5 respectively.

The upper support layer 12 is heated. This can be accomplished by a variety of methods. Generally, it is desirable to heat the upper support layer 12 from below. This results in better heat distribution throughout the upper support layer 12.

5 In the primary embodiment, the upper support layer 12 is heated by a heating mechanism 20 inserted directly between the upper and lower layers, as shown in the exploded view of Figure 2. As shown in Figure 3, the heating mechanism 20 preferably has the form of a longitudinal strip 22 with heating coils or wire 24 formed therein. The heating strip, as well as any adhesive thereon,
10 should be formed of a material that will not melt or otherwise deteriorate due to heat generated in the heating coils or wire. Various printed, etched strips of heating coils are available for this purpose, such as those supplied by Thermal Circuits, Boston, Massachusetts, USA. Such a construction provides for relatively simple and cost effective assembly, although other arrangements are within the
15 scope of this invention.

As best seen in Figures 1 and 4, the primary embodiment has the upper support layer 12, lower support layer 18, and heating mechanism 20 wrapped together inside a sheath 25, typically made of cloth. The sheath 25 would bind the upper support layer 12, lower support layer 18 and heating mechanism 20
20 together, so that the bundled whole may be picked up and used as desired.

Optionally, an embodiment of the invention may have a heat-reflective layer 27 interposed between the heating mechanism 20 and the lower support layer 18 as depicted in Figure 5. By reflecting heat that would otherwise enter the lower support layer 18, this would render the transfer of heat to the upper support
25 layer 12 more effective. The heat-reflective layer 27 could for example be a sheet of aluminum foil.

Another embodiment of the invention illustrated in Figure 6, includes the addition of a heat distribution plate 26 between the upper and lower support layers. The heating mechanism 20 could then be located in thermal contact with
30 the plate 26. The plate 26 should be thermally conductive, so that heat is transferred from the heating mechanism 20 to upper support layer 12. It is meant by heat conductive that it should transfer heat to a user relatively quickly. It must also be more conductive than the lower support layer 18. As shown in Figure 7, the plate 26 has the form of a metal plate including a planar surface 28
35 surrounding a concave recess 30, the concave recess 30 facilitating retention of upper support member 12 in position on the plate. However, the plate 26 could have a variety of configurations. The plate 26 simply needs to distribute heat to the upper support layer 12 in a uniform manner

The upper support member 12 may be separately removable from the plate 26. If it is removable, the upper support member 12, once heated, could be removed from the plate 26 by an operator and placed on a part of the body to obtain heat therapy.

5 The strip 22 may be adhered directly to the plate 26 with an adhesive. The adhesive should be chosen so that it will not melt when the heating mechanism 20 is activated. In this embodiment, the strip 22 preferably has sufficient flexibility to conform to the bottom surface of the plate 26. It may also be encapsulated into a molded support, which itself makes contact with the plate 26.

10 The heating mechanism 20 could also be located inside the upper support layer 12. It would consist of a heat conductive rod or bar extending into the gel-filled membrane of the upper support layer.

The above outlined methods are preferred embodiments of the invention and not meant to be an exhaustive list of how the upper support layer 12 may be heated. Other methods of heating the upper support layer 12 may be used as well.

15 The entire support device may be mounted in a base 40 (Figure 4). In a preferred embodiment, the base 40 would include an elongate hollow shell with a top opening extending along a longitudinal axis of the shell. In this configuration, it would be composed of a bottom, planar surface and two inwardly inclined surfaces diverging towards one another from opposed edges of the bottom surface the upper edges of the surfaces being separated from each other by the opening. The heated support device 10 may be placed within the opening at the top of the shell. End supports may also be included to increase the stability of the heated support device.

25 The base 40 should be made of a relatively rigid material strong enough so that it will not bend under the combined weight of an operator's wrist and the support device 10. Additionally, the base 40 would preferably be constructed of a material with heat conductivity low as compared to that of the upper support member 12, so that minimal heat generated by the heating mechanism 20 is transferred to the base member. A suitable material is a plastic resin such as acrylonitrile-butadiene-styrene (ABS).

30 Alternative constructions of the base 40 are within the scope of this invention. For example, the base 40 may not include separate bottom and end support members, and the various base members need not have the form of a shell but may be constructed of a solid plastic material.

35 As mentioned, the embodiment illustrated in Figure 1 is especially adapted for use in conjunction with a computer keyboard. Accordingly, for this embodiment, upper support member 12 preferably has a length between about 10 and about 20 inches (250 and 500 mm), especially between about 14 and about 18

inches (360 and 460 mm). Also, according to the described embodiment, the upper support member 12 has a width of between about 1 and about 3 inches (25 and 75 mm), especially about 1.5 inches (40 mm).

Figure 3 also illustrates that the device may include an electrical cord 32 for connecting the device to a power source. For the illustrated embodiment, the cord 32 is connected to the heating mechanism 20. A control 34 may be located along a section of the cord or it may be located on the housing if one is used. The control 34 would include a thermostat to regulate the temperature generated in the heating mechanism 20. A knob 36 may also be provided on the exterior of the control 34 to provide for manual adjustment of the thermostat by a user. It is understood that other configurations are possible, the main consideration being that a power source is provided for the heat unit. A battery power source might be used, such as a rechargeable battery housed in the base 40, in electrical connection with the heating mechanism 20.

The device 10 may be adapted for use in conjunction with a computer mouse. Since the upper support member needs to accommodate only one wrist of an operator, the upper support member 12 has a shortened length. For example, its length may be between about 3 and about 7 inches (75 and 180 mm), especially between about 4 and about 6 inches (100 and 150 mm). The heating mechanism 20, the lower support layer 18, and the base member are sized accordingly to accommodate a support member of this size. This embodiment may also include electrical connections. This embodiment may also be placed adjacent to, and used in conjunction with, a desktop calculator such as those used in the accounting field.

As for the previously described embodiments, once the upper support layer 12 has been heated, the support device 10, may be picked up and placed on a part of the body to obtain heat therapy. The size and shape of the support device may be varied to better support various parts of the body.

Each of the described embodiments provides an improved device for supporting at least a portion of the wrist or hand during operation of a computer keyboard, mouse or the like. The flexible, deformable upper support member 12 is comfortable to the wrist or hand, and at least partially conforms to the operator's wrist or hand when supported thereon. The device provides heat to a wrist or hand supported thereon so to relieve fatigue and/or reduce stress induced by repetitive motion. It is preferred that the support member is heatable to a temperature above ambient room temperature (72° F, 22° C), and preferably it is heatable to a temperature above normal body temperature (98.6° F, 37° C). It may be desired that the heat distribution plate may be initially heated to a relatively high temperature (for example, 140° F, 60° C) to provide quicker initial heating of

the upper support member, where the operator may adjust the temperature downward after the upper support member is heated initially.

In summary, then, the invention is directed to a heating device with dual flexible and deformable support layers, the upper support layer 12 being relatively
5 heat-conducting and able to conform to a portion of the user's anatomy, the lower support layer 18 being thermally insulating relative to the upper support layer 12, a heating mechanism 20 being placed between the upper and lower layers.

While preferred embodiments of the invention have been shown and described with particularity, it will be appreciated that various changes and
10 modifications may suggest themselves to one having ordinary skill in the art upon being apprised of the present invention. It is intended to encompass all such changes and modifications as fall within the scope and spirit of the appended claims.

In the Claims:

1. A device for supporting at least a portion of a wrist or hand, comprising:
 - (a) an upper support layer comprising a flexible, deformable body;
 - (b) a lower support layer located beneath the upper support layer;
 - (c) a heating mechanism in thermal contact with a lower part of the upper support layer.
2. The device of Claim 1, wherein the lower support layer is a flexible and deformable body.
3. The device of Claim 1, wherein the lower support layer has a greater thermal conductivity than the upper support layer.
4. The device of Claim 1, further comprising a layer heat reflective between the heating mechanism and the lower support layer.
5. The device of Claim 1, further comprising an at least substantially rigid hollow base member having the form of a shell sized to receive the lower support.
6. The device of Claim 1, wherein the upper support layer comprises a flexible casing with a thermally conductive fluid therein.
7. The device of claim 6, wherein the fluid is a liquid-containing medium having a viscosity higher than 1 poise at 20° C.
8. The device of claim 7, wherein the fluid is a liquid-containing medium having a viscosity of at least 15 poise at 20° C.
9. The device of Claim 6, wherein the flexible casing is sealed.
10. The device of Claim 1, wherein the lower support layer comprises a layer of foam.
11. The device of claim 1, where the heating mechanism is located intermediate the upper support layer and the lower support layer.
12. The device of claim 11, further comprising an outer sheath surrounding the upper support layer, heating mechanism, and lower support layer.
13. The device of claim 1, wherein the upper support layer has sufficient deformability to partially conform to the weight of a wrist or hand supported thereon.
14. The device of claim 13, wherein the upper support layer does not fully collapse under the weight of a wrist or hand supported thereon.
15. The device of claim 1, further comprising a heat distributor intermediate the upper support layer and the heating mechanism.
16. The device of claim 15, wherein the heat distributor comprises a metal plate.

17. An apparatus for heating a portion of a wrist or hand, comprising:
- (a) a bladder;
 - (b) a thermally conductive gel disposed in the bladder; and
 - (c) a heating element in the bladder in thermal contact with the gel.
18. The apparatus of Claim 17, wherein the liquid is a gel.
19. The apparatus of Claim 17, wherein the gel has sufficient viscosity to retain the heating element in a predetermined position within the bladder.
20. The apparatus of Claim 17, further comprising a flexible wrap disposed about the bladder.
21. An input device, comprising:
- (a) a frame;
 - (b) a user actuable input connected to the frame;
 - (c) a bladder connected to the frame, the bladder including a thermally conductive gel; and
 - (d) a heating element thermally coupled to the gel.
22. The input device of Claim 21, wherein the gel has a viscosity greater than 1 poise at 20° C.
23. The input device of Claim 21, wherein the heating element is at least partially disposed within the bladder.
24. The input device of Claim 21, wherein the bladder is integral with the frame.
25. The input device of Claim 21, wherein the bladder is separable from the frame.
26. The input device of Claim 21, further comprising a flexible wrap surrounding the bladder.
27. A method for heating a portion of a wrist or hand of an input device operator, comprising locating a bladder containing a gel to contact one of the wrist or hand of the operator during operation of the input device; actuating a heating element thermally coupled to the gel; and heating the gel to a sufficient temperature to heat the portion of the hand or wrist during operation of the input device.

28. The method of Claim 27, further comprising locating a heating element within the gel.
29. The method Claim 27, further comprising retaining the gel within a flexible bladder.
30. The method of Claim 27, further comprising locating the heating element at least partially within the bladder.
31. The method of Claim 27, further comprising disposing a flexible wrap about a portion of the bladder.

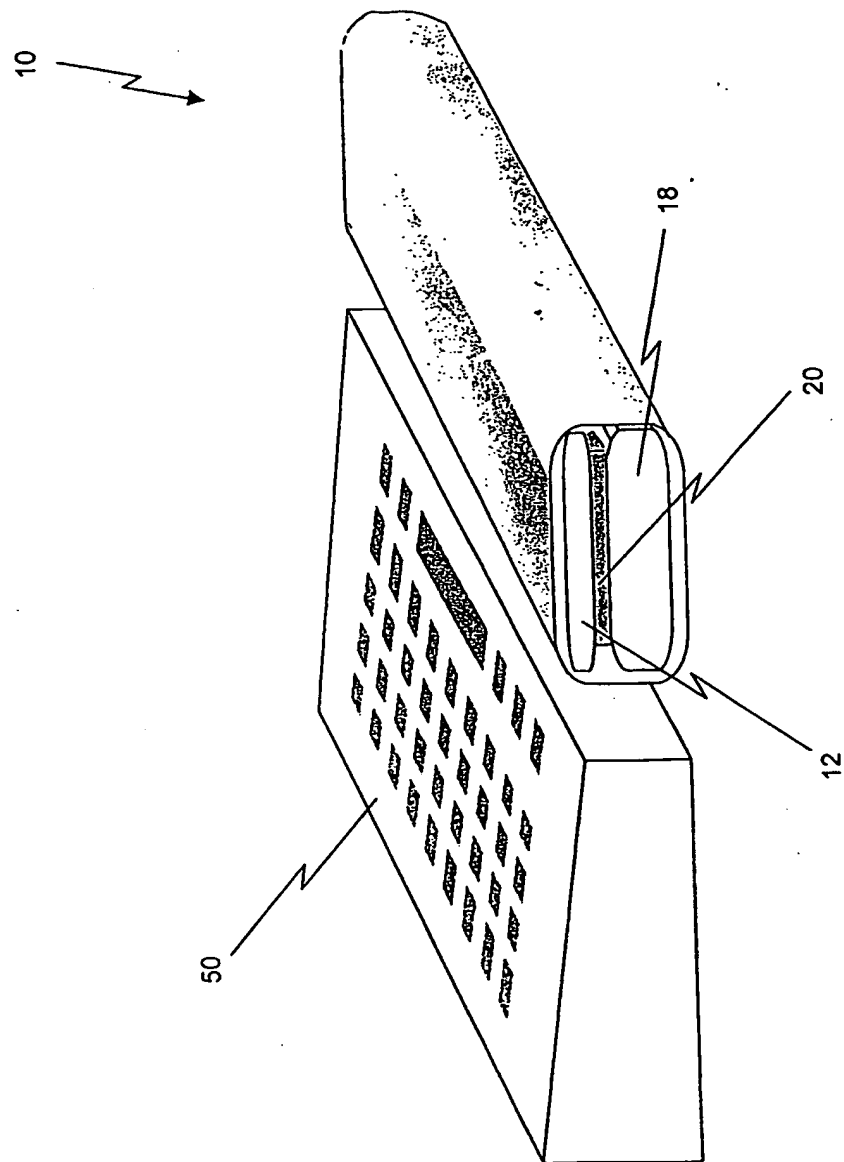


Fig. 1

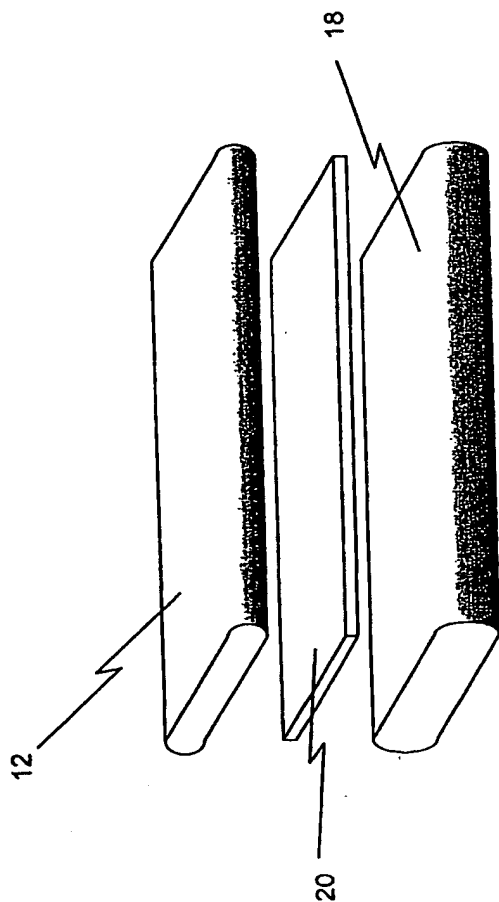


Fig. 2

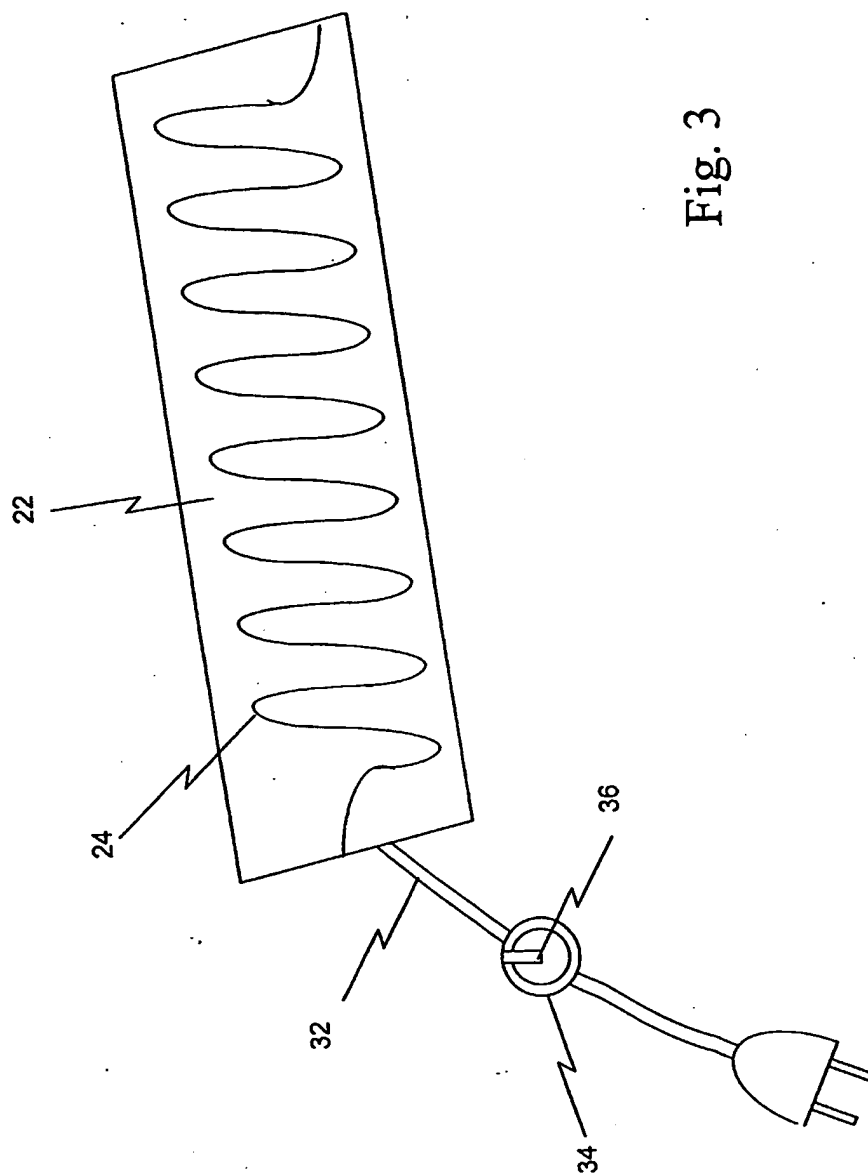


Fig. 3

Fig. 5

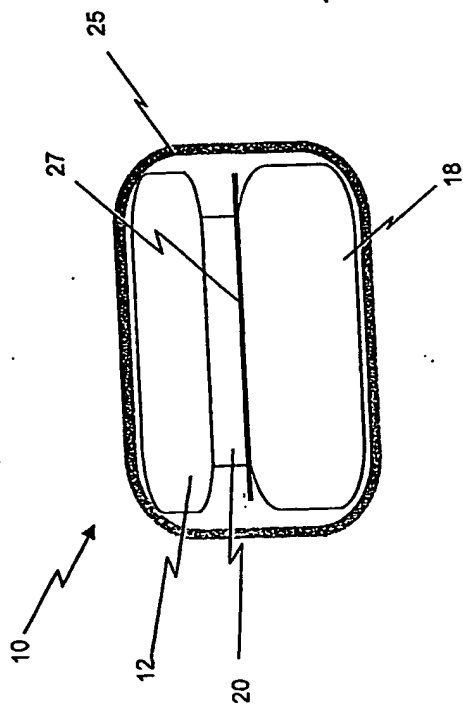


Fig. 4

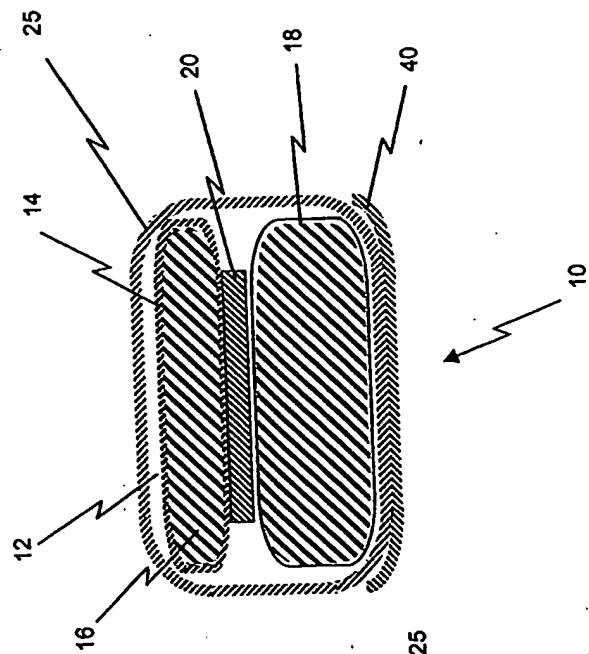
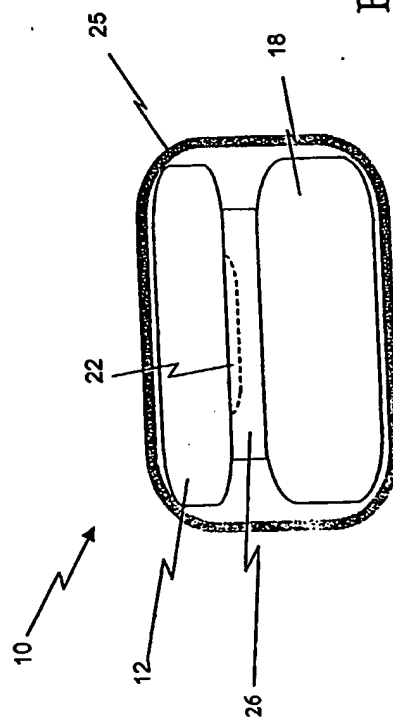


Fig. 6



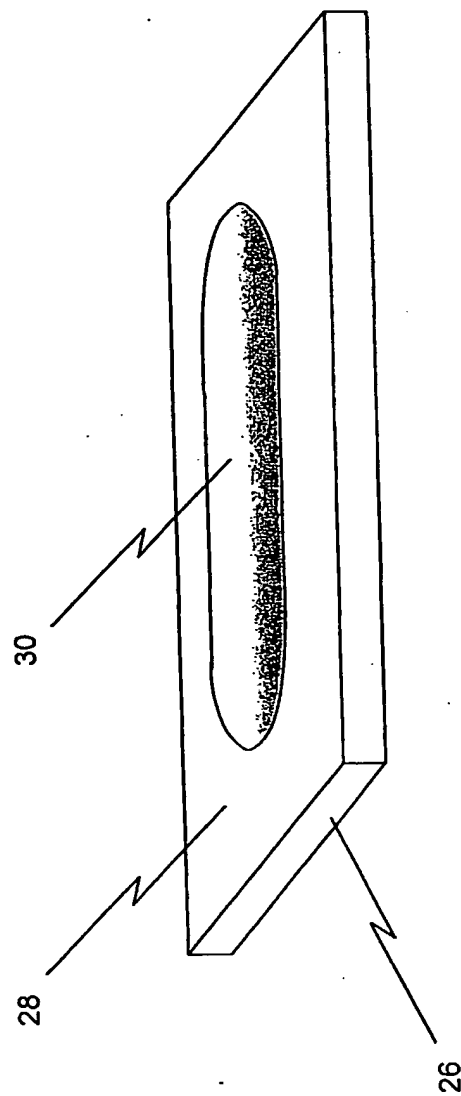


Fig. 7

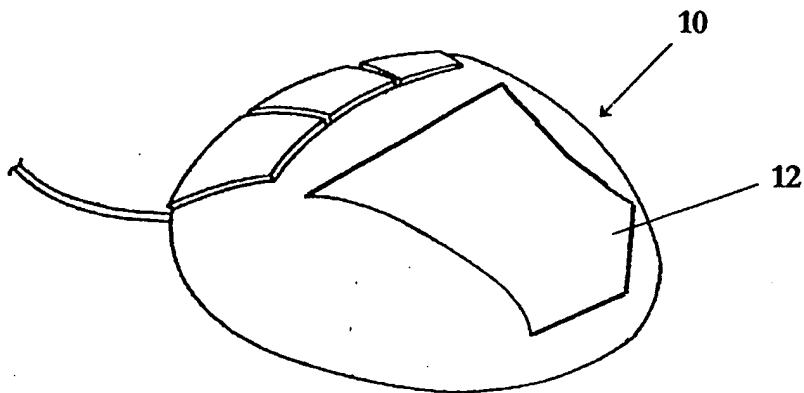


FIGURE 8

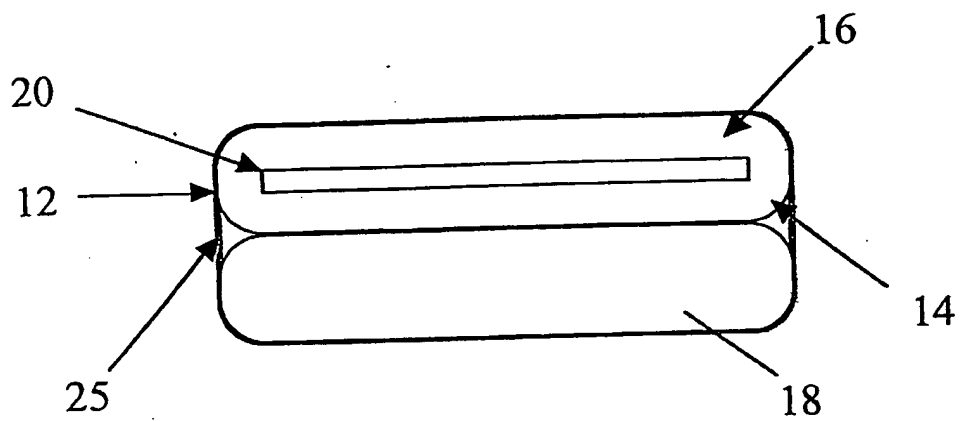


FIGURE 9

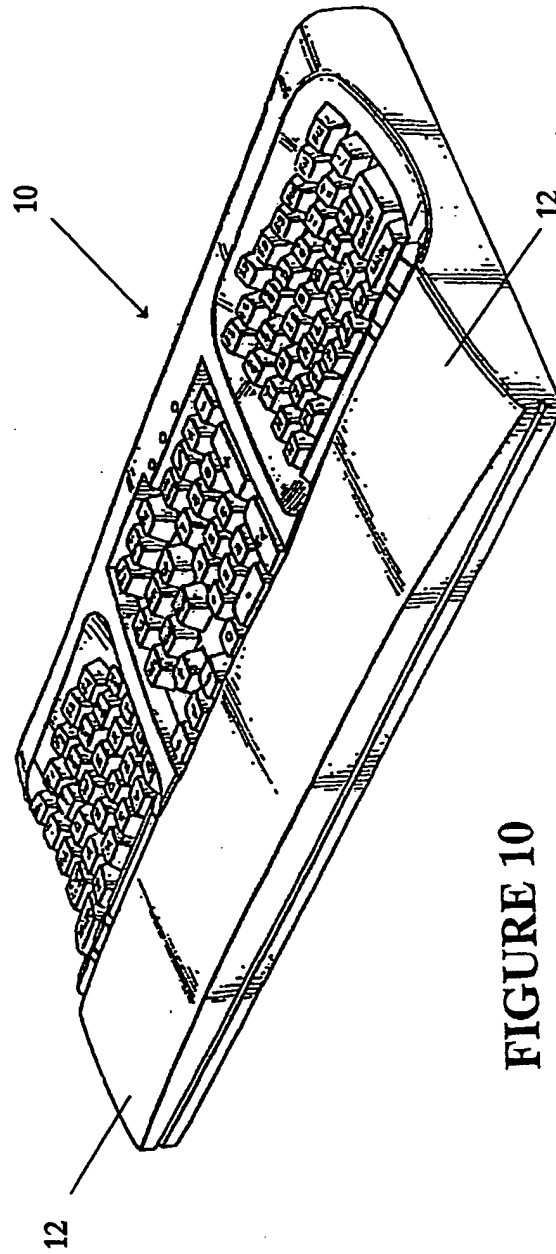


FIGURE 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/13184

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H05B 3/34; B43L 15/00; A61F 7/00

US CL : 219/217, 544, 549, 529, 201; 248/118.1, 918; 400/715; 601/15; 607/98, 111, 152

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 219/217, 544, 549, 529, 201; 248/118.1, 918; 400/715; 601/15; 607/98, 111, 152

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Derwent WPI, JPO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,133,556 A (RAMSEY et al) 17 October 2000, Fig. 2.	1-26
Y	US 5,034,594 A (BEEZHOLD et al) 23 July 1991, Figs. 1-3.	1-26
Y	US 5,686,005 A (WRIGHT, Sr.) 11 November 1997, entire document.	1-26
Y	US 5,980,143 A (BAYER et al) 09 November 1999, entire document.	1-26
A	US 5,566,913 A (PROKOP) 22 October 1996, Fig. 1-4.	1-26
A	US 5,599,280 A (WOLDEN) 04 February 1997, entire document.	1-26
A	US 5,476,491 A (MAYN) 19 December 1995, entire document.	1-26
A	US 2,617,916 A (NEIDNIG) 11 November 1952, Fig. 1-3.	1-26
A	US 2,873,352 A (FRANCO) 10 February 1959, Fig. 1, 2.	1-26

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search

25 September 2001 (25.09.2001)

Date of mailing of the international search report

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Washington, D.C. 20231

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/13184

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-26

Remark on Protest

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The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

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C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 29818988 U1 (MEYERHOEFER) 22 April 1999, entire document.	1-26

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BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claim(s) 1-26, drawn to an apparatus for heating a portion of a wrist or hand.

Group II, claim(s) 27-31, drawn to a method for heating a portion of a wrist or hand of an input device operator during operation of an input device.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: Under PCT Rule 13.2, they lack the same or corresponding special technical features. The apparatus claims are rendered obvious to the ordinary routineer in the art as shown by Bayer et al in view of Wright, Sr. As the recited structure does not make a contribution over the prior art, unity of invention is lacking.